Science UK: Self-repair technology – text

Aeroplane wings, offshore wind turbines and sports equipment may all be able to repair themselves soon with this incredible new technology.

In the first *Terminator* movie, there is a moment when this metal machine from the future begins to repair his mechanical arm. The Terminator's capacity for self-repairing is an exercise of frightening intelligence that transforms this brutal killing machine into something living, something more human. The ability of non-human things to interact with the environment and repair themselves surprises and fascinates many people. This is perhaps one reason for the extraordinary media interest around the research being done by Professor Duncan Wass and his team of researchers at the University of Bristol. They have developed a self-repairing material that could be used to fix the wings and body of aeroplanes.

This idea originally began in a casual conversation. Professor Wass, from the university's School of Chemistry, was chatting to his colleagues in aerospace engineering. 'I'm a chemist and the engineers were saying they had a problem,' he explains. One of the particular problems they had is that materials get damaged – that could be small objects from a runway flying up and damaging the body of an aeroplane, or a bird hitting the plane – it can be very difficult to detect the damage and repair it.

Over the last ten years, composite materials have become very important materials in aircraft building – they are strong and light, providing better fuel-efficiency, saving money and the environment. The Boeing 787 Dreamliner achieved its fuel efficiency partly through its fuselage being constructed from composite materials instead of aluminium. The energy industry also uses composite materials in constructing wind turbines.

Professor Wass and his team sat down with the engineers and found inspiration in the processes of the human body. 'If we get damaged, say if you cut your finger, there are mechanisms that repair that damage. These self-healing functions that we have, can we put them in an airplane wing? If you do that, you're not going to be able to repair a huge great hole in the airplane wing, but what we should be able to repair are the tiny cracks that lead to the problems later on.'

Their starting point was research into other work in the field; as Wass says, 'you realise that lots of people have been looking at self-healing in all sorts of systems. What I would say is that a lot of what's gone on before works really well in the lab – if you want to actually get it to work in real life you'd see some fundamental mistakes.' Wass explains, 'it's taken us three years to do this, because there is lots of hard work in the lab to get something that really works.'

So when an excited media asks when is the work going to be incorporated in an aeroplane, it really depends on commercial issues. 'I can have something that is ready to go, but that doesn't address the commercial challenges and the will within industry to actually apply this as well,' says Professor Wass. In any case, because of the safety issues, aeroplanes are the most challenging application of the technology, says Wass. Offshore wind turbines are another possible application as they are difficult to get to and repair. He also lists other materials: 'bicycle frames or sports equipment [are] generally where you can imagine this being used.' But excitable media have highlighted other potential applications – smartphone screens and self-healing nail polish. 'If you look round the web you will see people claiming we are saying we will repair those things,' says Professor Wass. 'That's the press inventing their own stories, I didn't realise it was such an issue! We'd need to find a slightly different way to do it, but it would be great if we could solve that.'

If you're interested in science check out the British Council's science magazine called Cubed.